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Second Quarterly Progress Report
(July - September, 1973)

for

"A Cloud Physics Investigation
Utilizing Skylab Data"

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During this reporting period (July - September, 1973) progress in the following task areas was achieved.

Task I - Transmittances

a. Oxygen "A" Band

A program that calculates the atmospheric transmission has been written using the lines parameters reported by Burch and Gryvnak [1]. The program has been checked against experimental data taken by Burch and Gryvnak [1]. Good agreement between calculated and measured transmittance has been obtained. To insure accurate calculation of transmittance over the entire range of atmospheric pressure and temperature, the Voigt line shape has been included as well as the Lorentz line shape. For the Voigt calculations a program reported by Armstrong [2] has been adapted. A comparison between the two line shapes for a limiting case (i.e., where pressure broadening is the dominant factor in determining the line shape) has been done and excellent agreement between the two has been obtained.

b. $2.0 \mu\text{m CO}_2$ Band

Little work has been done on this band. The possibility of doing band model calculations is still being considered,

although the logic of our "A" band line by line model is sufficiently general to permit its use for line by line calculations. Also we have the AFCRL compilation of atmospheric absorption line parameters [3].

The personnel involved in this task are Alishouse, Van Cleef, and Hill.

Task II - Scattering Calculations

The scattering calculations are virtually complete. All water cloud models for all wavelengths have been completed and all ice cloud models have been completed except the "A" band wavelengths. Due to the extremely large size parameters involved (as large as 826), Dr. Jacobowitz has determined that a geometric optics approximation is required. It is anticipated these calculations will be completed this quarter.

Task III - Cloud Models and Returned Signal

a. Cloud Models

We have previously reported the size distributions assumed for the models. In addition phase functions using the layer doubling technique have been computed for 25 optional thickness ranging in thickness from 2^{-20} to $32(2^5)$. This task is complete.

b. Returned Signal

We plan to combine the results of Tasks I, II, and III a, to compute the expected transmissions for actual sun-satellite geometries.

Task IV - Deconvolution Procedure

No work has been done on this task due to unexpectedly heavy demands upon Mr. Fleming's time by other projects and the continued unavailability of S191 spectral calibration data. We hope to complete this task during the third quarter.

Task V - Cloud Truth Data

We have been advised that there were data takes for this investigation on August 3, 4, 5, 8, 9, and 11, but no pilot reports were available. Data was taken on September 10, 12, and 15. We are currently checking the availability of pilot reports.

Task VI - Analysis and Reduction of Satellite Data

We have made very little progress on this task because we have received no data.

Travel

No travel was performed for this investigation during the reporting period.

References

1. Burch, D. E. and D. A. Gryvnak, "Strengths, Widths, and Shapes of the Oxygen Lines Near 7600 Angstroms" Philco-Ford Publication No. V-4076 Final Report for Contract No. CWB-11344, 31 May, 1967, Newport Beach, California.
2. Armstrong, B. H., JQSRT, 7, 61, (1967).
3. McClatchey, R. A., W. S. Benedict, S. A. Clough, D. E. Burch, R. F. Calfee, K. Fox, L. S. Rothman, and J. S. Garing, "AFCRL TR-73-0096 26 January 1973 Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Bedford, Massachusetts.

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